



# STGB20NB32LZ STGB20NB32LZ-1

## N-CHANNEL CLAMPED 20A - D<sup>2</sup>PAK/I<sup>2</sup>PAK INTERNALLY CLAMPED PowerMESH™ IGBT

TYPE	V <sub>CES</sub>	V <sub>CE(sat)</sub>	I <sub>C</sub>
STGB20NB32LZ	CLAMPED	< 2.0 V	20 A
STGB20NB32LZ-1	CLAMPED	< 2.0 V	20 A

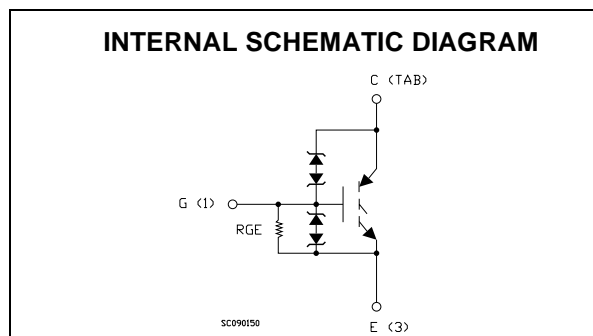
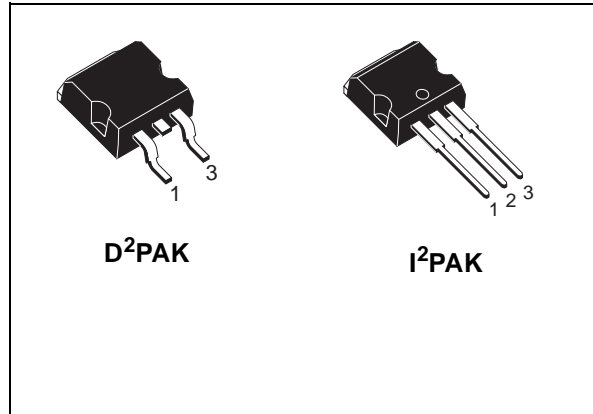
- POLYSILICON GATE VOLTAGE DRIVEN
- LOW THRESHOLD VOLTAGE
- LOW ON-VOLTAGE DROP
- HIGH CURRENT CAPABILITY
- HIGH VOLTAGE CLAMPING FEATURE
- SURFACE-MOUNTING D<sup>2</sup>PAK (TO-263)  
POWER PACKAGE IN TUBE (NO SUFFIX) OR  
IN TAPE & REEL (SUFFIX "T4")

### DESCRIPTION

Using the latest high voltage technology based on a patented strip layout, STMicroelectronics has designed an advanced family of IGBTs, the PowerMESH™ IGBTs, with outstanding performances. The built in collector-gate zener exhibits a very precise active clamping while the gate-emitter zener supplies an ESD protection.

### APPLICATIONS

- AUTOMOTIVE IGNITION



### ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V <sub>CES</sub>	Collector-Emitter Voltage (V <sub>GS</sub> = 0)	CLAMPED	V
V <sub>ECR</sub>	Reverse Battery Protection	20	V
V <sub>GE</sub>	Gate-Emitter Voltage	CLAMPED	V
I <sub>C</sub>	Collector Current (continuous) at T <sub>C</sub> = 25°C	40	A
I <sub>C</sub>	Collector Current (continuous) at T <sub>C</sub> = 100°C	30	A
I <sub>CM</sub> (•)	Collector Current (pulsed)	80	A
E <sub>as</sub>	Single Pulse Energy T <sub>C</sub> = 25°C	700	mJ
P <sub>tot</sub>	Total Dissipation at T <sub>C</sub> = 25°C	150	W
	Derating Factor	1	W/°C
E <sub>SD</sub>	ESD (Human Body Model)	4	KV
T <sub>stg</sub>	Storage Temperature	-65 to 175	°C
T <sub>j</sub>	Max. Operating Junction Temperature	175	°C

(•)Pulse width limited by safe operating area

**STGB20NB32LZ - STGB20NB32LZ-1****THERMAL DATA**

Rthj-case	Thermal Resistance Junction-case Max	1	°C/W
Rthj-amb	Thermal Resistance Junction-ambient Max	62.5	°C/W
Rthc-sink	Thermal Resistance Case-sink Typ	0.2	°C/W

**ELECTRICAL CHARACTERISTICS** ( $T_{CASE} = 25\text{ °C}$  UNLESS OTHERWISE SPECIFIED)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
BV <sub>(CES)</sub>	Clamped Voltage	I <sub>C</sub> = 2 mA, V <sub>GE</sub> = 0, T <sub>C</sub> = -40°C	330	355	380	V
		I <sub>C</sub> = 2 mA, V <sub>GE</sub> = 0, T <sub>C</sub> = 25°C	325	350	375	V
		I <sub>C</sub> = 2 mA, V <sub>GE</sub> = 0, T <sub>C</sub> = 150°C	320	345	370	V
BV <sub>(ECR)</sub>	Emitter Collector Break-down Voltage	I <sub>C</sub> = 75 mA, T <sub>C</sub> = 25°C	20	28		V
BV <sub>GE</sub>	Gate Emitter Break-down Voltage	I <sub>G</sub> = ± 2 mA	12	14	16	V
I <sub>CES</sub>	Collector cut-off Current (V <sub>GE</sub> = 0)	V <sub>CE</sub> = 15 V, V <sub>GE</sub> = 0, T <sub>C</sub> = 150 °C			10	μA
		V <sub>CE</sub> = 200 V, V <sub>GE</sub> = 0, T <sub>C</sub> = 150°C			100	μA
I <sub>GES</sub>	Gate-Emitter Leakage Current (V <sub>CE</sub> = 0)	V <sub>GE</sub> = ± 10 V, V <sub>CE</sub> = 0	± 400	± 660	± 1000	μA
R <sub>GE</sub>	Gate Emitter Resistance		10	15	25	KΩ

ON (1)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V <sub>GE(th)</sub>	Gate Threshold Voltage	V <sub>CE</sub> = V <sub>GE</sub> , I <sub>C</sub> = 250μA, T <sub>C</sub> = -40°C	1.2			V
		V <sub>CE</sub> = V <sub>GE</sub> , I <sub>C</sub> = 250μA, T <sub>C</sub> = 25°C	1	1.4	2	V
		V <sub>CE</sub> = V <sub>GE</sub> , I <sub>C</sub> = 250μA, T <sub>C</sub> = 150°C	0.6			V
V <sub>CE(SAT)</sub>	Collector-Emitter Saturation Voltage	V <sub>GE</sub> = 4.5V, I <sub>C</sub> = 10 A, T <sub>C</sub> = 25°C		1.1	1.8	V
		V <sub>GE</sub> = 4.5V, I <sub>C</sub> = 10 A, T <sub>C</sub> = 150°C		1	1.7	V
		V <sub>GE</sub> = 4.5V, I <sub>C</sub> = 20 A, T <sub>C</sub> = 25°C		1.35	2	V
		V <sub>GE</sub> = 4.5V, I <sub>C</sub> = 20 A, T <sub>C</sub> = 150°C		1.25	2	V

**DYNAMIC**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g <sub>fs</sub>	Forward Transconductance	V <sub>CE</sub> = 25 V, I <sub>C</sub> = 20 A		35		S
C <sub>ies</sub>	Input Capacitance	V <sub>CE</sub> = 25 V, f = 1 MHz, V <sub>GE</sub> = 0		2300		pF
C <sub>oes</sub>	Output Capacitance			165		pF
C <sub>res</sub>	Reverse Transfer Capacitance			28		pF
Q <sub>g</sub>	Gate Charge	V <sub>CE</sub> = 280 V, I <sub>C</sub> = 20 A, V <sub>GE</sub> = 5 V		51		nC

## FUNCTIONAL CHARACTERISTICS

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
II	Latching Current	$V_{\text{Clamp}} = 250 \text{ V}$ , $T_C = 150^\circ\text{C}$ $R_{\text{GOFF}} = 1\text{K}\Omega$ , $V_{\text{GE}} = 4.5 \text{ V}$	80			A
U.I.S.	Functional Test Open Secondary Coil	$R_{\text{GOFF}} = 1\text{K}\Omega$ , $L = 3 \text{ mH}$ , $T_C = 25^\circ\text{C}$ $R_{\text{GOFF}} = 1\text{K}\Omega$ , $L = 3\text{mH}$ , $T_C = 150^\circ\text{C}$	21.6 15	26 18		A A

## SWITCHING ON

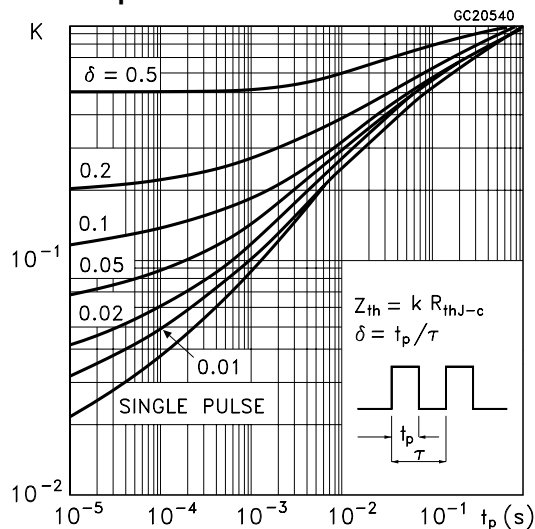
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(\text{on})}$ $t_r$	Delay Time Rise Time	$V_{\text{CC}} = 250 \text{ V}$ , $I_C = 20 \text{ A}$ $R_G = 1\text{K}\Omega$ , $V_{\text{GE}} = 4.5 \text{ V}$		2.3 0.6		$\mu\text{s}$ $\mu\text{s}$
$(di/dt)_{\text{on}}$	Turn-on Current Slope	$V_{\text{CC}} = 250 \text{ V}$ , $I_C = 20 \text{ A}$ $R_G = 1\text{K}\Omega$ , $V_{\text{GE}} = 4.5 \text{ V}$		550		A/ $\mu\text{s}$
$E_{\text{on}}$	Turn-on Switching Losses	$V_{\text{CC}} = 250 \text{ V}$ , $I_C = 20 \text{ A}$ , $T_C = 25^\circ\text{C}$ $R_G = 1\text{K}\Omega$ , $V_{\text{GE}} = 4.5 \text{ V}$ , $T_C = 150^\circ\text{C}$		8.8 9.2		mJ mJ

## SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_c$ $t_r(V_{\text{off}})$ $t_f$ $t_{d(\text{off})}$ $E_{\text{off}}(**)$	Cross-Over Time Off Voltage Rise Time Fall Time Off Voltage Delay Time Turn-off Switching Loss	$V_{\text{CC}} = 250 \text{ V}$ , $I_C = 20 \text{ A}$ , $R_{\text{GE}} = 1 \text{ K}\Omega$ , $V_{\text{GE}} = 4.5 \text{ V}$		4.8 2.6 2 11.5 11.8		$\mu\text{s}$ $\mu\text{s}$ $\mu\text{s}$ $\mu\text{s}$ mJ
$t_c$ $t_r(V_{\text{off}})$ $t_f$ $t_{d(\text{off})}$ $E_{\text{off}}(**)$	Cross-Over Time Off Voltage Rise Time Fall Time Off Voltage Delay Time Turn-off Switching Loss	$V_{\text{CC}} = 250 \text{ V}$ , $I_C = 20 \text{ A}$ , $R_{\text{GE}} = 1 \text{ K}\Omega$ , $V_{\text{GE}} = 4.5 \text{ V}$ $T_C = 150^\circ\text{C}$		7.8 3.5 3.9 12 17.8		$\mu\text{s}$ $\mu\text{s}$ $\mu\text{s}$ $\mu\text{s}$ mJ

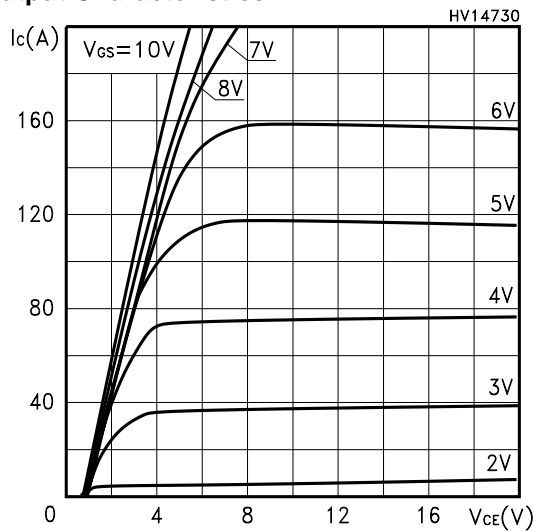
(\*\*) Losses Include Also the Tail (jedec Standardization)

## Thermal Impedance

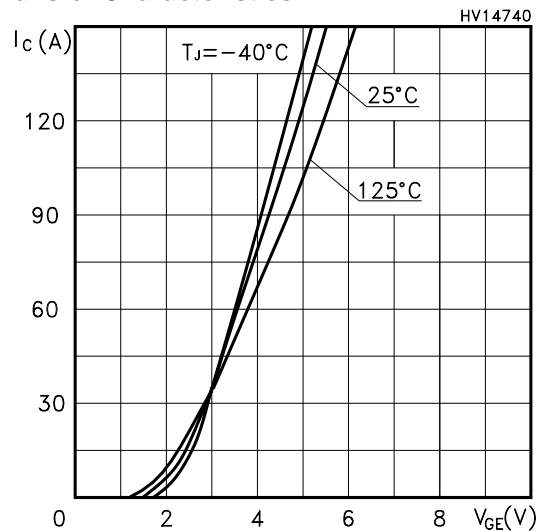


## STGB20NB32LZ - STGB20NB32LZ-1

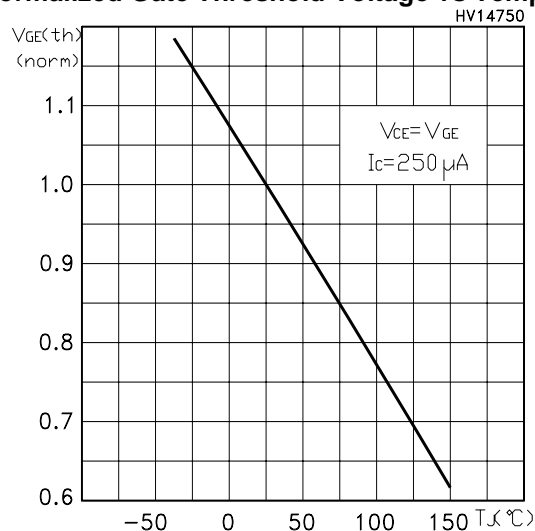
**Output Characteristics**



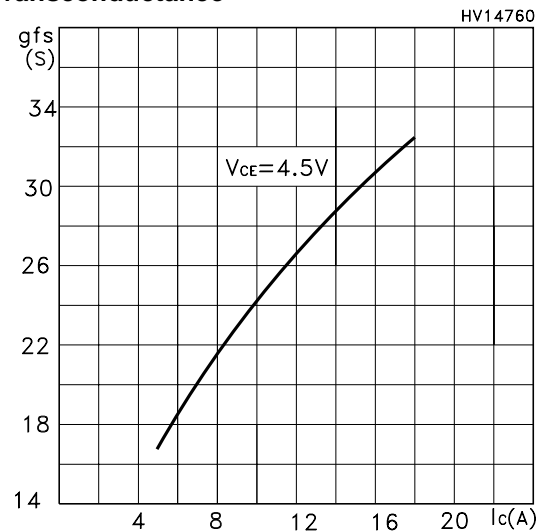
**Transfer Characteristics**



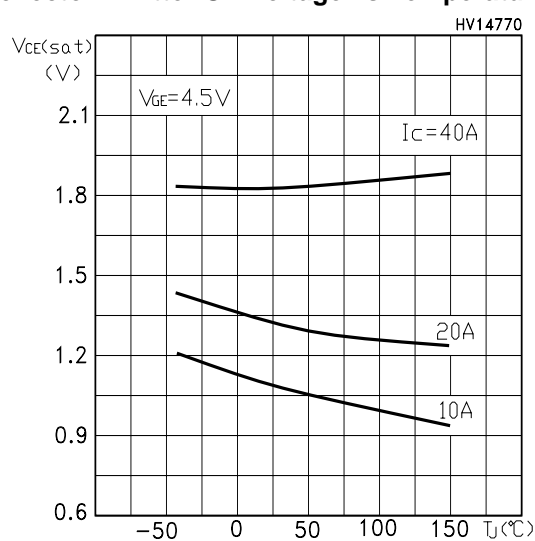
**Normalized Gate Threshold Voltage vs Temp.**



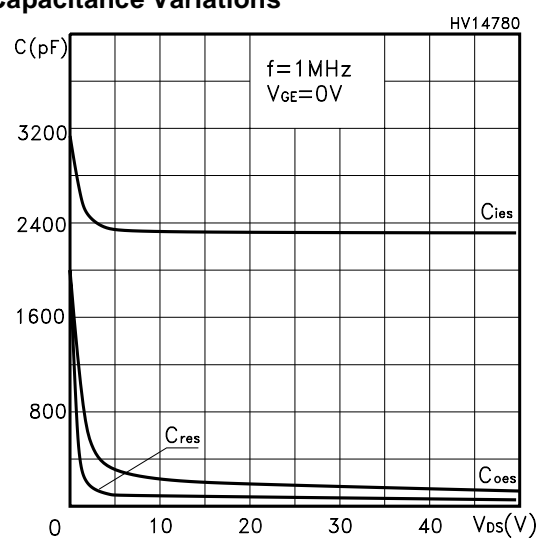
**Transconductance**



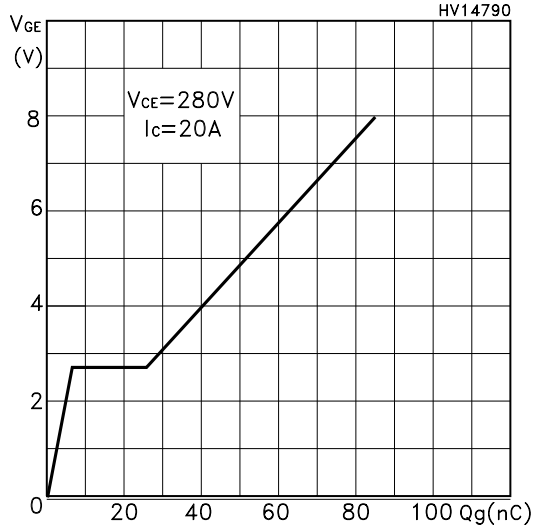
**Collector-Emitter On Voltage vs Temperature**



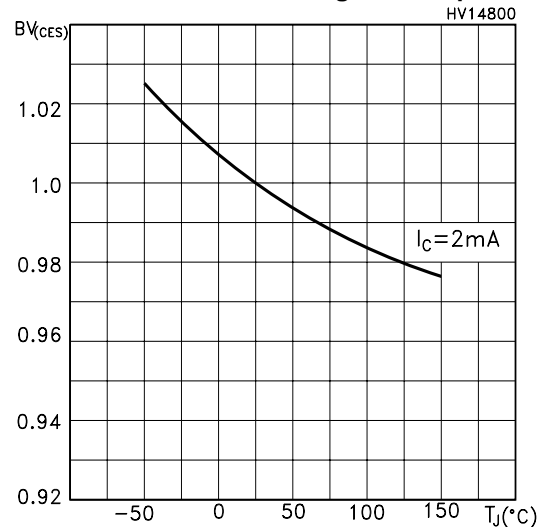
**Capacitance Variations**



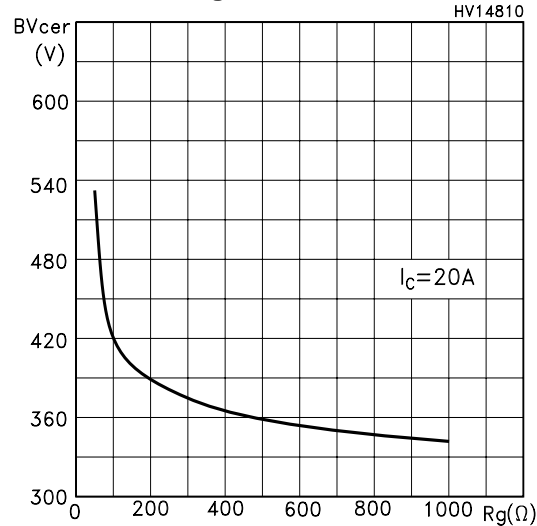
Gate Charge vs Gate-Emitter Voltage



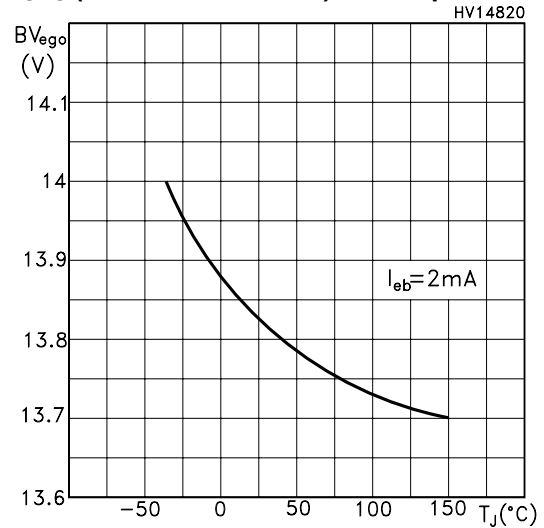
Normalized BreakDown Voltage vs Temperature



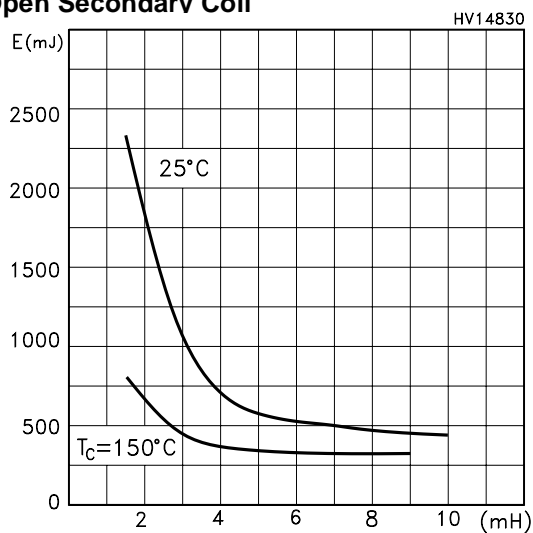
Break-Down Voltage vs Emitter Resistance



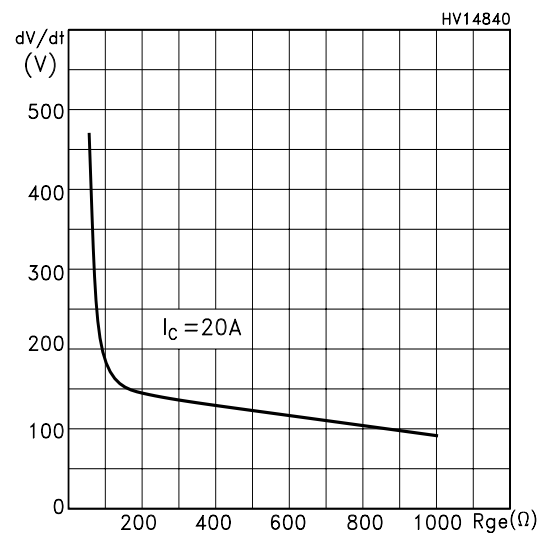
BVGE0 (Zener Gate-Emitter) vs Temperature



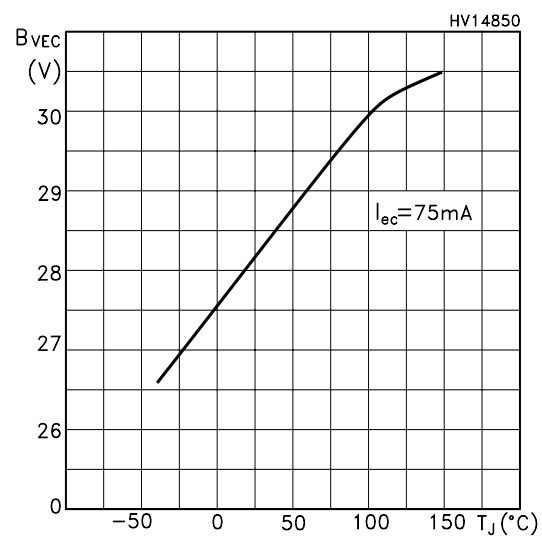
Self Clamped Inductive Switching Energy vs Open Secondary Coil



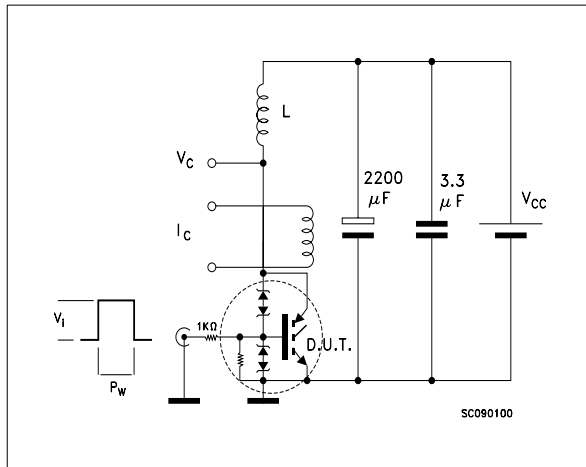
dV/dt Gate-Emitter Resistance



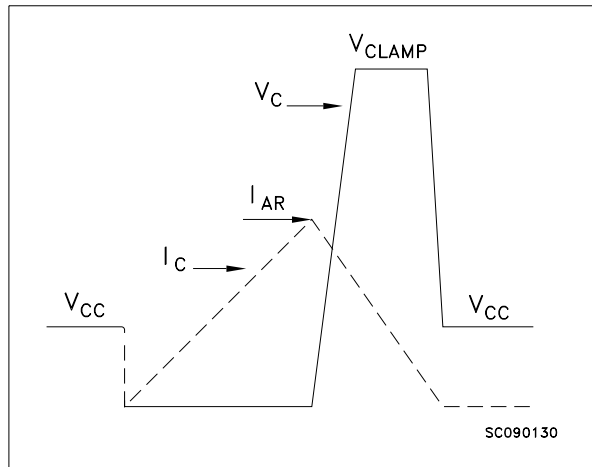
### B<sub>VEC</sub> Reverse Battery Voltage



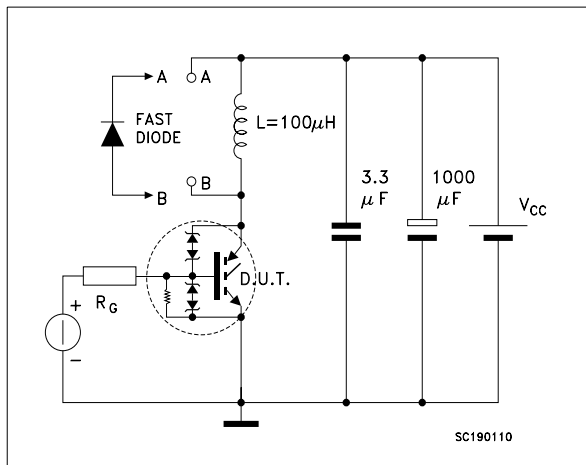
**Fig. 1: Unclamped Inductive Load Test Circuit**



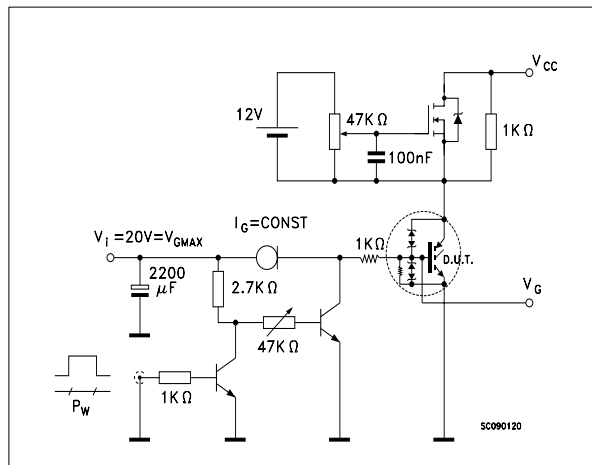
**Fig. 2: Unclamped Inductive Waveform**



**Fig. 3: Test Circuit For Inductive Load Switching And Diode Recovery Times**

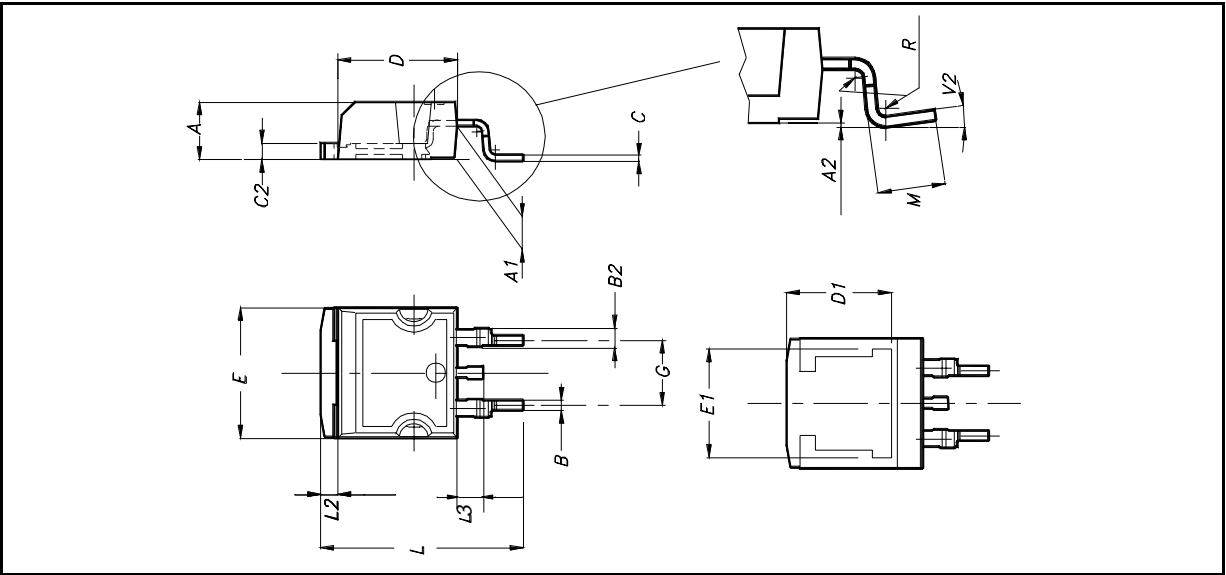


**Fig. 4: Gate Charge test Circuit**



D<sup>2</sup>PAK MECHANICAL DATA

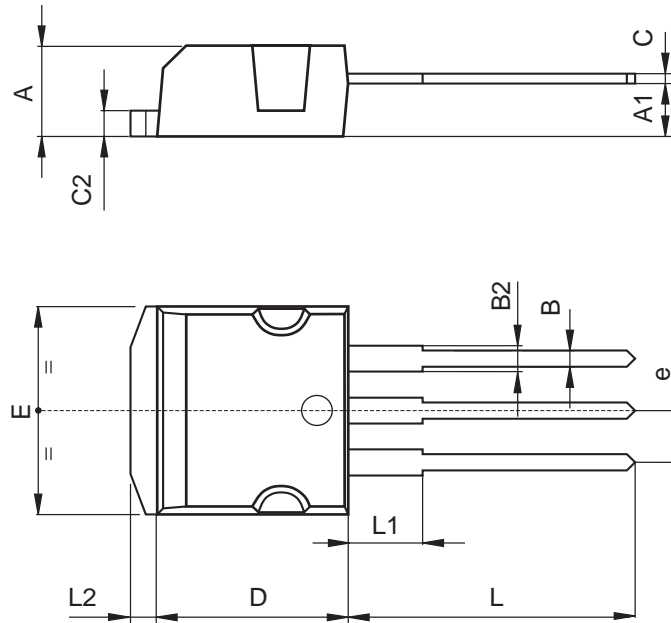
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.4		4.6	0.173		0.181
A1	2.49		2.69	0.098		0.106
A2	0.03		0.23	0.001		0.009
B	0.7		0.93	0.027		0.036
B2	1.14		1.7	0.044		0.067
C	0.45		0.6	0.017		0.023
C2	1.23		1.36	0.048		0.053
D	8.95		9.35	0.352		0.368
D1		8			0.315	
E	10		10.4	0.393		
E1		8.5			0.334	
G	4.88		5.28	0.192		0.208
L	15		15.85	0.590		0.625
L2	1.27		1.4	0.050		0.055
L3	1.4		1.75	0.055		0.068
M	2.4		3.2	0.094		0.126
R		0.4			0.015	
V2	0°		8°			





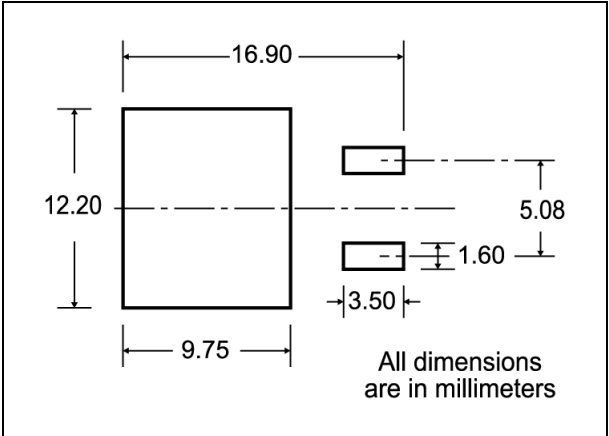
TO-262 (I<sup>2</sup>PAK) MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.4		4.6	0.173		0.181
A1	2.49		2.69	0.098		0.106
B	0.7		0.93	0.027		0.036
B2	1.14		1.7	0.044		0.067
C	0.45		0.6	0.017		0.023
C2	1.23		1.36	0.048		0.053
D	8.95		9.35	0.352		0.368
e	2.4		2.7	0.094		0.106
E	10		10.4	0.393		0.409
L	13.1		13.6	0.515		0.531
L1	3.48		3.78	0.137		0.149
L2	1.27		1.4	0.050		0.055

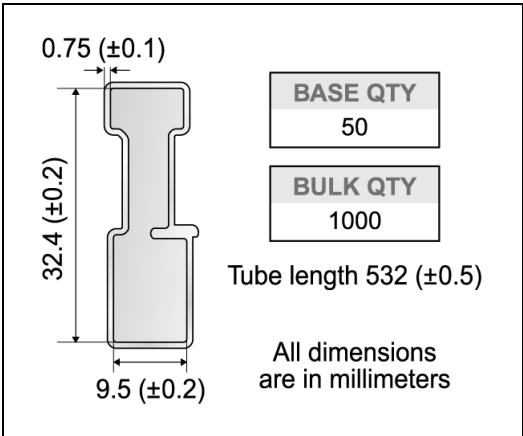


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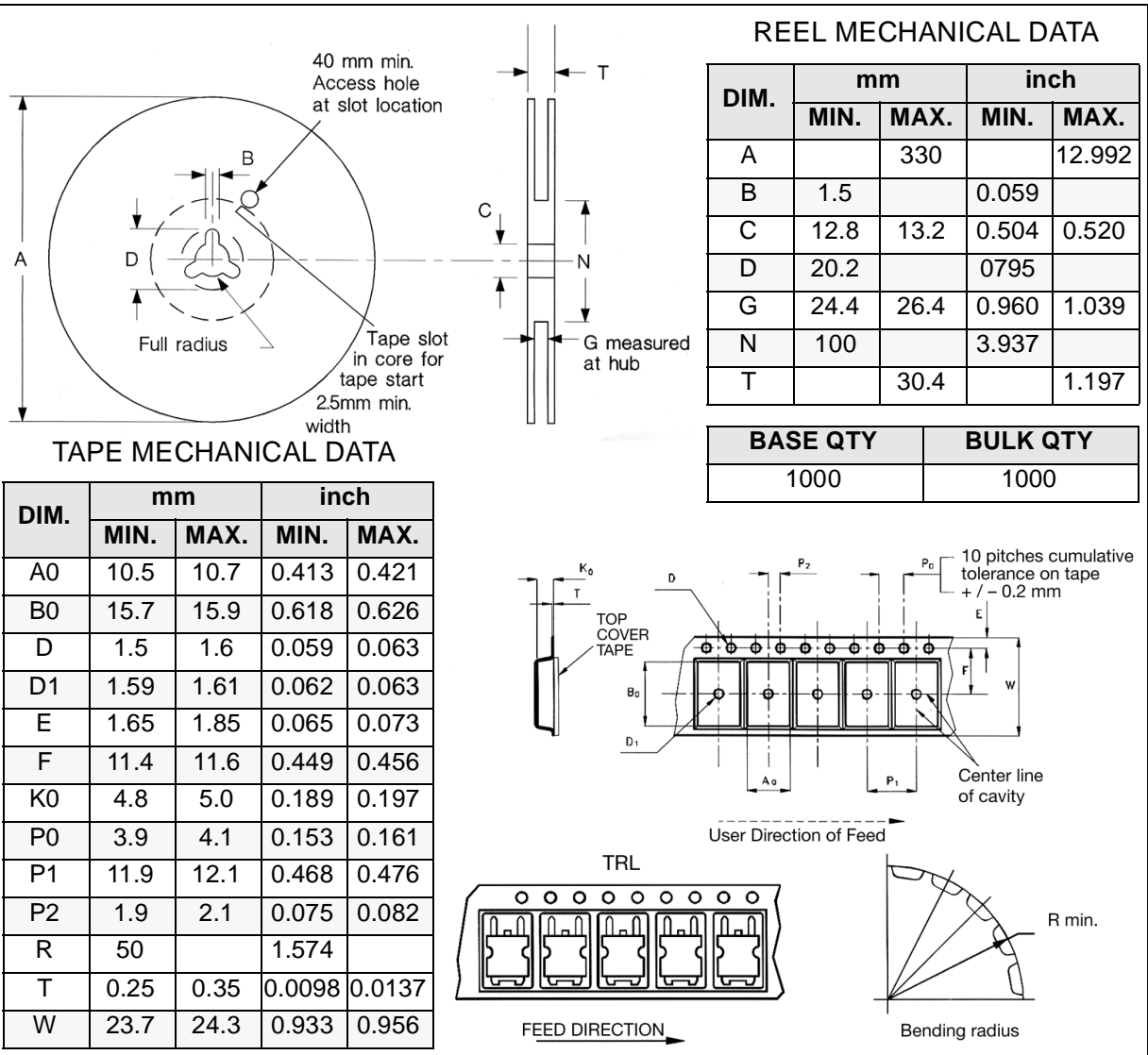
D<sup>2</sup>PAK FOOTPRINT



TUBE SHIPMENT (no suffix)\*



TAPE AND REEL SHIPMENT (suffix "T4")\*



\* on sales type  
10/11

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